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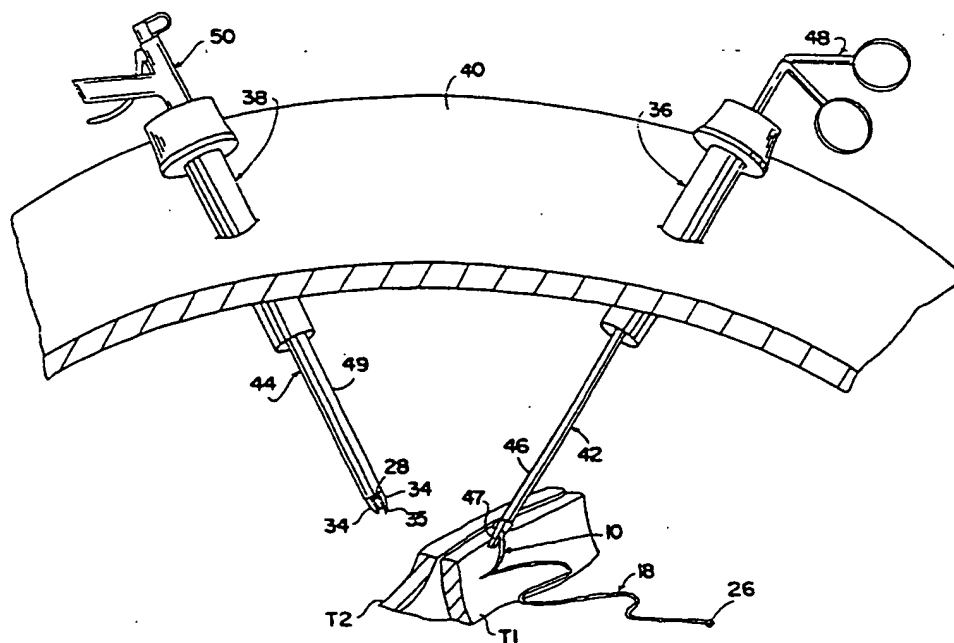
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## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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<p>(21) International Application Number: PCT/US94/00048 (22) International Filing Date: 5 January 1994 (05.01.94) (30) Priority Data: 08/002,479 6 January 1993 (06.01.93) US (71)(72) Applicant and Inventor: YOON, InBae [US/US]; 2101 Highland Ridge Drive, Phoenix, MD 21131 (US). (74) Agent: EPSTEIN, Robert, H.; Epstein, Edell &amp; Retzer, Suite 220, 1901 Research Boulevard, Rockville, MD 20850 (US).</p>	<p>(81) Designated States: CA, JP, KR, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).  Published With international search report. Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</p>	

(54) Title: SUTURING METHOD, APPARATUS AND SYSTEM FOR USE IN ENDOSCOPIC PROCEDURES



(57) Abstract

A method, system and apparatus for suturing tissue (T1), (T2) in an anatomical cavity during an endoscopic procedure includes a suturing instrument (36) extending through a portal in the anatomical cavity wall for manipulating a needle (10) to penetrate the tissue to form a looped portion of a length of suture material at an exit point in the tissue and to back the needle out of the tissue, and an anchor (28) applier instrument (38) extending through another portal in the anatomical cavity wall for positioning an anchor in engagement with the looped portion of the suture material to allow the suture material to be tensioned and secured to adjustably approximate the tissue.

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What I Claim Is:

1. A method for suturing tissue in an anatomical cavity during an endoscopic procedure comprising the steps of  
penetrating the tissue at an entry point with a needle having a length of suture material attached thereto until a portion of the length of suture material has passed through the tissue and out of an exit point;  
engaging the length of suture material adjacent the exit point with an anchor;  
backing the needle proximally out of the tissue at the entry point while the anchor holds a portion of the length of suture material at the exit point;  
tensioning the length of suture material by pulling the length of suture material away from the entry point; and  
securing the length of suture material in the tensioned position.
2. A method for suturing tissue as recited in claim 1 wherein said securing step includes clamping the anchor to the length of suture material at the exit point.
3. A method for suturing tissue as recited in claim 1 wherein said securing step includes clamping another anchor to the length of suture material at the entry point.
4. A method for suturing tissue as recited in claim 1 wherein the length of suture material has an enlarged proximal end and said tensioning step includes pulling the length of suture material away from the entry point to cause the enlarged proximal end to abut the tissue at the entry point.
5. A method for suturing tissue as recited in claim 1 wherein said penetrating, engaging, backing out and tensioning steps form a single stitch and further comprising repeating said penetrating, engaging, backing out and tensioning steps in sequence to form a plurality of stitches and thereafter performing said securing step.

6. A method for suturing tissue as recited in claim 5 wherein said securing step includes clamping another anchor to the length of suture material at the entry point for the last stitch.

7. A method for suturing tissue as recited in claim 1 wherein said penetrating, engaging, backing out, tensioning and securing steps form a single stitch and further comprising repeating said penetrating, engaging, backing out, tensioning and securing steps in sequence to form a plurality stitches.

8. A method for suturing tissue as recited in claim 7 wherein said securing steps include clamping the anchor for each stitch to the length of suture material at the exit point for each stitch.

9. A method for suturing tissue as recited in claim 1 and further comprising, after said penetrating step and before said engaging step, the step of proximally moving the needle a short distance to cause the portion of the length of suture material adjacent the exit point to move away from the needle to create a space therebetween.

10. A method for suturing tissue as recited in claim 9 wherein said engaging step includes positioning the anchor in the space between the portion of the length of suture material and the needle.

11. A method for suturing tissue as recited in claim 10 wherein the needle has a sharp tip and the length of suture material is attached to the needle adjacent the sharp tip and wherein said proximally moving step includes moving the sharp tip proximally toward the exit point.

12. A method for suturing tissue as recited in claim 9 wherein said engaging step includes positioning an anchor having a pair of spaced legs terminating at spaced distal ends

such that the legs extend on opposite sides of the portion of the length of suture material spaced from the needle.

13. A method for suturing tissue as recited in claim 11 wherein said engaging step includes squeezing the legs of the anchor to cause the distal ends of the legs to be closed.

14. A method for suturing tissue as recited in claim 13 wherein said securing step includes squeezing the legs of the anchor to clamp the anchor to the length of suture material at the exit point.

15. A method for suturing tissue as recited in claim 1 and further comprising the step of hooking the length of suture material at the exit point prior to said engaging step.

16. A method for suturing tissue as recited in claim 1 further comprising the step of forming first and second spaced portals in a wall of the anatomical cavity and wherein said penetrating, backing out and tensioning steps are performed by a suturing instrument passing through the first portal and manipulated via a handle disposed externally of the anatomical cavity and said engaging step is performed by an anchor applier instrument holding a plurality of anchors passing through the second portal and manipulated via a handle disposed externally of the anatomical cavity.

17. A system for suturing tissue in an anatomical cavity during an endoscopic procedure comprising

a needle having a body terminating at a sharp distal end for penetrating the tissue to be sutured and an opposing proximal end to be held for manipulating the needle body in the cavity through a first portal in a wall of the cavity;

a length of suture material having a distal end attached to said needle body at an attachment position spaced from said needle proximal end by a distance greater than the thickness of the tissue to be sutured such that manipulation of said

needle body to cause said sharp distal end to penetrate forwardly through the tissue to be sutured at an entry point and out of an exit point pulls a portion of said length of suture material out of the exit point to form a loop of said length of suture material adjacent the exit point; and

an applier instrument carrying a plurality of anchors for application at a distal end of said applier instrument, said anchors having a configuration to engage said loop of said suture material, said applier instrument being manipulated in the cavity through a second portal through the cavity wall to place one of said anchors in engagement with said loop of said suture material to hold said loop of said suture material when said needle body is withdrawn rearwardly from the tissue and away from the entry point.

18. The system as recited in claim 17 wherein said anchors are clips having opposed legs movable to clamp said loop of said suture material.

19. The system as recited in claim 17 wherein said anchors have a central portion with opposing ends having transverse dimensions larger than the transverse dimension of said central portion, said loop of said suture material extending around said central portion of said anchors.

20. The system as recited in claim 17 wherein said applier instrument distal end includes a jaw tapering to a tip for hooking or holding said loop of said suture material.

21. The system as recited in claim 17 wherein said applier instrument distal end includes opposed jaws, one of said jaws being longer than the other of said jaws and curving toward said other jaw to taper to a tip for hooking or holding said loop of said suture material.

22. The system as recited in claim 17 wherein said needle includes an elongate operating member holding said

proximal end of said needle body and having a length to extend through the second portal.

23. A suturing instrument for use in suturing tissue in an anatomical cavity during an endoscopic procedure by inserting said suturing instrument through a portal in a wall of the anatomical cavity; said suturing instrument comprising

a needle having a body terminating at a sharp distal end and an opposing proximal end;

an elongate operating member having a distal end holding said needle body at said needle body proximal end and having a length to extend through the portal to a proximal end;

a handle receiving said operating member proximal end for manipulating said needle body within the anatomical cavity; and

a length of suture material having a distal end attached to said needle body at an attachment position spaced from said needle proximal end by a distance greater than the thickness of the tissue to be sutured such that manipulation of said needle body to cause said sharp distal end to penetrate forwardly through the tissue to be sutured at an entry point and out of an exit point pulls a portion of said length of suture material out of the exit point to form a loop of said length of suture material adjacent the exit point, said length of suture material having an enlarged proximal end having a transverse dimension greater than the transverse dimension of said length of suture material.

24. A suturing instrument as recited in claim 23 wherein said needle body proximal end is detachably held by said operating member distal end.

25. A suturing instrument as recited in claim 24 wherein said operating member distal end includes opposed relatively movable jaws for holding said needle body proximal end.

26. A suturing instrument as recited in claim 24 wherein said operating member has a longitudinal axis, said needle body proximal end includes a shank having a longitudinal axis aligned with said operating member longitudinal axis, and said needle body has a portion curving away from said shank, said shank being held by said operating member distal end whereby rotation of said operating member about said operating member longitudinal axis adjusts the position of said needle body to facilitate suturing.

27. A suturing instrument as recited in claim 23 wherein said needle body is integrally, undetachably formed with said operating member.

28. A suturing instrument as recited in claim 23 wherein said operating member has a longitudinal axis and said operating member proximal end is received in said handle to be selectively rotatable therein about said longitudinal axis.

29. A suturing instrument as recited in claim 28 wherein said needle body proximal end is held by said operating member distal end at a position spaced from said longitudinal axis.

30. A suturing instrument as recited in claim 23 wherein said operating member is tubular to form a lumen extending between said operating member proximal end distal ends providing communication with the anatomical cavity without removing said suturing instrument from the portal.

31. A suturing instrument as recited in claim 23 and further comprising an electrical connector carried on said operating member proximal end to permit use of said needle body as a cautery.

32. A suturing instrument as recited in claim 23 and further comprising a hollow safety shield movable between a distally extended protective position covering said needle



body and a proximally retracted operative position exposing said needle body.

33. A suturing instrument as recited in claim 32 wherein said safety shield is mounted on said handle and includes means biasing said safety shield toward said extending protective position and a trigger for moving said safety shield to said retracted operative position against said bias means.

34. A suturing instrument as recited in claim 23 wherein said needle body proximal end is movably held by said operating member distal end and further comprising control member means extending along said operating member from said needle body proximal end to said handle for moving said needle body relative to said operating member.

35. A suturing instrument as recited in claim 34 wherein said needle body proximal end includes a ball, said operating member distal end includes a socket capturing said ball and said control member means includes a plurality of control members attached to said ball.

36. An anchor applier instrument for use in suturing tissue in an anatomical cavity during an endoscopic procedure by inserting said anchor applier instrument through a portal in a wall of the anatomical cavity to engage a looped portion of a length of suture material, said anchor applier instrument comprising

- a barrel housing a plurality of anchors therein having a distal end for ejecting said anchors and a length to extend through the portal to a proximal end;

- a handle receiving said barrel proximal end for manipulating said anchor applier instrument within the anatomical cavity; and

- an anchor receiver positioned at said barrel distal end for receiving anchors ejected therefrom, said anchor receiving

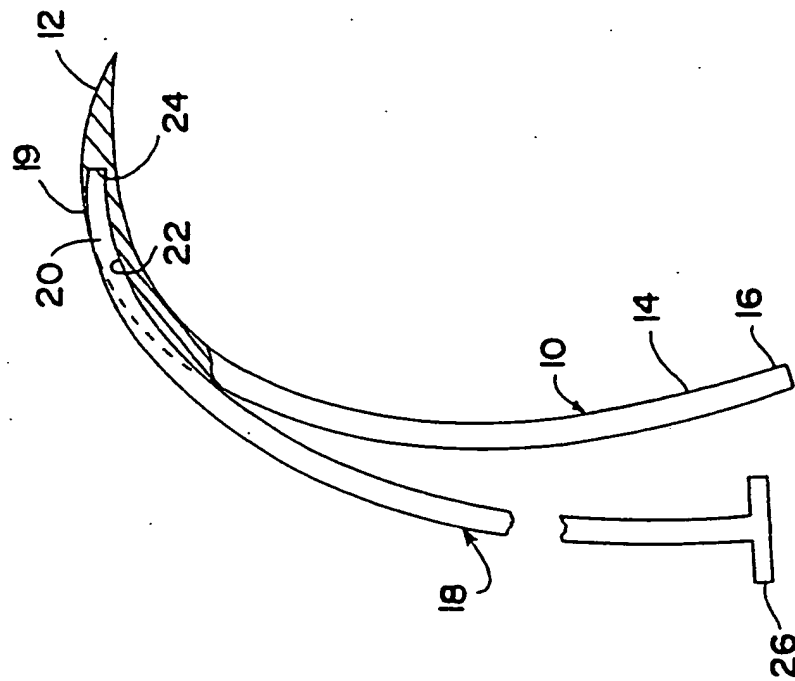
having a tapered tip for insertion in the looped portion of the length of suture material to position the looped portion in engagement with the anchor.

37. An anchor applier instrument as recited in claim 36 wherein said anchor receiver includes a pair of opposing jaws for receiving an anchor therebetween, one of said jaws extending beyond the other of said jaws to form said tapered tip.

38. An anchor applier instrument as recited in claim 37 wherein said barrel has a longitudinal axis and said opposing jaws are relatively movable laterally with respect to said barrel longitudinal axis.

39. An anchor applier instrument as recited in claim 37 wherein said barrel has a longitudinal axis and said opposing jaws are relatively movable along said barrel longitudinal axis.

40. An anchor applier instrument as recited in claim 36 wherein said anchor receiver includes a cradle for receiving an anchor therein and having a distal jaw forming said tapered tip.



**FIG. 1**

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